The Macro-Economics of Superstars
Digitization, Market Power, and Regulatory Responses

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Rosen (1981) first described the *Economics of Superstars*:

- information technology allows a small number of talented individuals to serve a large market and reap large rewards
  - description pre-dated the Internet
  - Rosen’s first example: comedians and TV
- superstars were a curious phenomenon in a handful of sectors
- but outside of the domain of traditional macroeconomics
Introduction

Over the past three decades, advances in IT, chiefly the Internet, have *supercharged the superstars phenomenon*

Superstars (broadly defined to capture both individuals and firms):

- have become macroeconomically relevant
- are important drivers of several recent aggregate trends:
  1. declining demand for labor (and traditional capital)
  2. declining labor share
  3. increasing rents
  4. rise in income inequality

In *“The Macro-Economics of Superstars,”* we analyze

- the recent forces behind
- the broader macro implications
- policy remedies
Intangible vs Physical Capital

Figure: Ratio of Intangible Capital to Physical Capital, for Top 4 firms vs All Others (by sales) within NAICS 4 digit industries, 1980 - 2014
(Source: Authors' calculations)
In “The Macro-Economics of Superstars” (with Ding Xuan Ng) we argue that:

- Rise of superstars is natural result of *digital innovation* = advances in *collection, processing, and provision of information*

- *Digital innovation* allows firms/entrepreneurs
  - to replace tasks performed by traditional labor *and* capital
  - using a technology that is copied at negligible cost

Examples: Internet entrepreneurs, finance professionals, sport stars, musicians, franchise owners, manufacturers who automate, etc.
Key Economic Mechanism

*Information* differs from other inputs to production:

- information is *non-rival*
  - digital innovation can supply a large market at low cost
  - gives rise to increasing returns

- information is *excludable*
  - generates monopoly power and economic rents
    (part of which are *actually needed* to pay for innovation)

→ Digital innovation supercharges the superstar effect
Baseline Model

Model structure:
- Unit mass of consumer-workers
- Two traditional factors: capital and labor
- Unit mass of intermediate goods combined into final good

Technologies for intermediate goods production:
- Traditional technology: Cobb-Douglas CRS
- Superstar technology: uses digital innovation to automate a fraction $\gamma$ of production
Baseline Model

Consumers:

- Inelastic labor supply \( L = 1 \)
- Final good obtained from differentiated intermediate goods with \( \epsilon > 1 \)
  \[
  Y = \left( \int Y_i^{1-\frac{1}{\epsilon}} \, di \right)^{\frac{\epsilon}{\epsilon-1}}
  \]
  with price of final good \( P = \left( \int P_i^{1-\epsilon} \, di \right)^\frac{1}{1-\epsilon} = 1 \) as numeraire
- Demand for each intermediate good is
  \[
  Y_i = (P_i)^{-\epsilon} Y
  \]
  \( \rightarrow \) inverse demand curve \( P_i(Y_i; \cdot) \)
Traditional Technology

- Traditional technology for intermediate goods:
  \[ Y_i = F_i(K_i, L_i) = A_i K_i^\alpha L_i^{1-\alpha} \]

  open access \( \rightarrow \) perfect competition

- Factors are hired at market prices \( R \) and \( W \)

- Total cost function with traditional technology
  \[ TC^T(Y_i) = \left( \frac{R}{\alpha} \right)^\alpha \left( \frac{W}{1-\alpha} \right)^{1-\alpha} \frac{Y_i}{A_i} \]

- Constant unit cost
  \[ UC^T(Y_i) = \left( \frac{R}{\alpha} \right)^\alpha \left( \frac{W}{1-\alpha} \right)^{1-\alpha} / A_i \]
Superstar Technology

- Consider an entrepreneur in sector $i$ who develops a digital innovation
  - that automates a fraction $\gamma_i \in (0, 1)$ of production tasks at negligible marginal cost
  - but that imposes a fixed cost $\xi_i \geq 0$
  - in baseline model: entrepreneur has exclusive right to the innovation (e.g. patent)
- The total and unit cost functions of superstars are

$$TC^S(Y_i) = (1 - \gamma_i) TC^T(Y_i) + \xi_i$$
$$MC^S(Y_i) = (1 - \gamma_i) UC^T(Y_i)$$

→ fixed cost generates increasing return
→ exclusiveness generates market power
Economic Effects of Superstar Technology

As an entrepreneur introduces a digital innovation/raises $\gamma_i$,
- she first out-competes traditional firms $\rightarrow$ superstar
- then profit margins rise with further digital innovation
- optimal markup is reached when $\gamma_i \geq \frac{1}{\epsilon}$:
  $\rightarrow$ further cost savings passed on to consumers

Flip-side: demand for labor and wages:
- at first, decline due to cost savings
  $\rightarrow$ labor-saving effect of innovation
- then rise again as low cost generates more demand for output
  $\rightarrow$ output scale effect of innovation
Digital Innovation and Superstar Profits

Figure: Digital innovation and aggregate factor shares

Note: asset prices also reflect PDV of superstar rents
Public Policy Implications

Proposition (Monopoly Distortions from Digital Innovation)

The free market economy suffers from

▶ insufficient digital innovation
▶ inefficiently low output

Intuition: markups distort quantities and by extension innovation decision

Policy Remedies:

▶ 1st-best: use public investment to finance digital innovation
  → basic research should be public
▶ most other policy interventions have two-sided effects, e.g. breaking up monopolies, freeing information flows, etc.:
  ▶ one the one hand, they reduce monopoly rents
  ▶ on the other hand, they also reduce innovation
Simple extension to focus on factor bias:
digital innovation $\xi_i$ requires different factor inputs than traditional production
- typically intensive in higher-skilled labor, capital
- low-skilled labor experiences losses
First-order implications for international policy cooperation:

Note: global superstars are global natural monopolies

If superstar and displaced traditional firms located in different countries:

- superstar countries experience most of the gains from progress
- other countries increasingly left behind
  (esp. developing countries without domestic superstars)

→ requires novel considerations for trade policy
Macro Dynamics under Price Stickiness

Short-run aggregate demand effects: arise because of imperfect price adjustment

Two implications:

1. Phillips curve flatter:
   ▶ role of variable costs diminished
   ▶ fixed costs are not (less) responsive to slack in demand

2. when demand for low-skill labor declines: wage rigidities give rise to unemployment
In my paper on “Artificially Intelligent Agents in Our Economy,” I argue that:

▶ the rise of human superstars is just the beginning

▶ *artificially intelligent agents* (AIAs)
  ▶ are increasingly generating superstar rents of their own
  ▶ and absorb them in the form of investment expenditure
  ▶ while leaving regular human workers behind

▶ creating an economy “of the machines, by the machines, for the machines”
Conclusions

Information economy drives creation of superstars:

- digitization gives rise to natural monopolies
- generates large inequality
  (silver lining: limited by optimal monopoly markup)
- creates dilemmas for regulators and policymakers